HOW TO MAKE YOUR OWN TRACER AMMO

By Ted Avellone, aka "Ted in Tallahassee"

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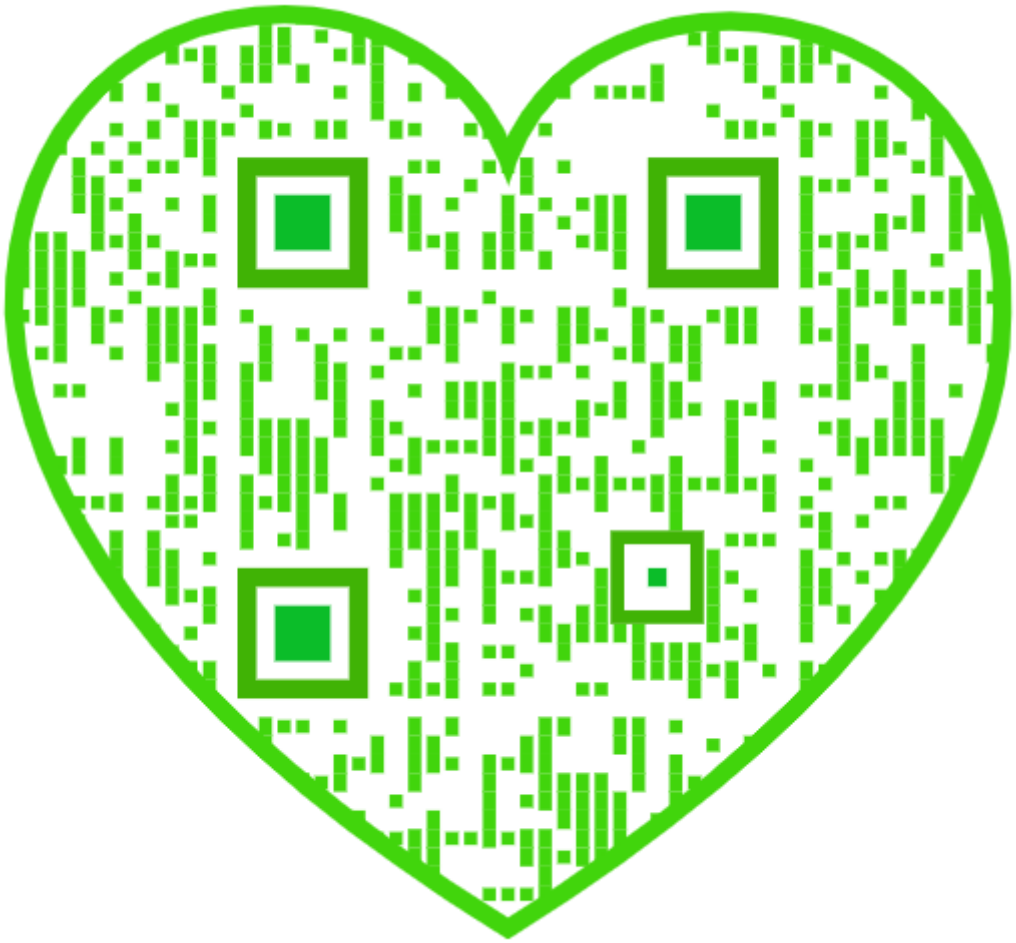
A Step-By-Step Guide to the Art of Making Your Own Tracer Ammunition

This pamphlet is intended to serve as a practical guide for reloaders and others who have always wanted to make their own tracer ammunition but didn't really know how to begin. While there have been several booklets offered for sale on the subject, most of these are, in the author's opinion, seriously lacking in complete information and often describe incorrect, unworkable and even dangerous techniques. In contrast, the information herein describes proven techniques which have been followed by at least several different individuals and have resulted in the manufacture of thousands of bright, reliable tracer rounds in several different calibers.

(Acknowledgement: Nearly all of the information in this pamphlet comes originally from tracer-making pioneer Ed Richardson, a Class 2 manufacturer who is a brilliant machinist and inventor from Middleburg, FL, who is otherwise known by many in the Class 3 community as "the guy that shoots the green tracers at Knob Creek". Ed spent years perfecting the techniques described herein. In my quest to learn how to make my own tracer ammo, Ed acted as the " master" to my apprenticeship and courteously took the time to personally demonstrate to me the details of his manufacturing process and otherwise endured my endless questions as I struggled along the way, ultimately to successful tracer making. I attempt here to organize this unique information into a comprehensive "how-to" manual, with accompanying photographic explanations, in order to memorialize it and share it with others. It is my hope that in taking the time to put this information together here I have spared both Ed and I the necessity of having to repeat the same information many times over in the future, as Ed has already done over the past several years. Special thanks also to Class 2 manufacturer Mike Newsome of Gainesville, FL who first referred me to Ed in response to a post I had made on Tom Bowers' Subguns.com board early on in my tracer-making endeavors.)



Foreword

Many people say they want to know how to make tracer ammunition. Human nature being what it is, most want a quick, easy, and inexpensive way to do it. But there is no such way, which helps to explain why pistol-caliber tracer ammunition is virtually impossible to find, and when you can, it's extremely expensive. For many, the only real solution to having large quantities of inexpensive tracer ammunition for personal enjoyment is to "roll your own."

Even so, it is likely that more than ninety-nine percent of the people who read this pamphlet will be discouraged and say it's too complicated, or too expensive, or both, and will never even begin to try to make their own tracers.

This pamphlet then is dedicated to that one percent of us in the shooting and reloading community who have the will and the way, but simply lacked enough information to get started.

- Ted

A BRIEF DESCRIPTION OF TRACER AMMUNITION

A tracer bullet is one that has had a cavity drilled in its base which has been filled with an incendiary material which ignites upon the cartridge's firing, allowing the shooter and others to clearly observe the bullet in-flight, for sight correction, an incendiary effect upon the target, signalling, or simply for shooting enjoyment. During manufacturing, this material must be compressed at almost exactly the same pressure as the chamber pressure that will exist in the host cartridge at the moment of firing. For example, in the case of a 9mm cartridge where the peak chamber pressure is approximately 30,000 psi, the tracer material must be compressed at very near to 30,000 psi in order to work successfully. If the mixture is not compressed enough, upon firing it will come apart in the bore and there will be a bright flash of color at the muzzle. If the composition has been compressed too much, the tracer material will simply fail to ignite.

This pamphlet will explain how to:

1) Obtain and/or make the tools and equipment needed to make and load tracer ammo.

2) Obtain and mix the chemical tracer compounds you will need.

3) Calculate the pressures needed to press your first test loads, loading, and field testing techniques.

The initial setup and tool-up process is by far the most expensive, frustrating and time-consuming step in the tracer making project. But once you've got that behind you, then all you have to do is occasionally mix batches of the chemical compounds and drill out batches of bullets. After that, one can leisurely press out a batch of tracer bullets, load them into ammunition in the normal fashion, and enjoy shooting them! As a long time reloader, the author likens tracer making as being a natural progression to the hobby of reloading. Once you get used to shooting your own tracer ammo, shooting "ordinary" non-tracer ammo seems positively boring!

DISCLAIMER: Please note that while in the author's opinion the making of tracer ammunition appears to be no more dangerous than doing things such as mowing a lawn, cutting up wood with a chainsaw, eating oysters in June or having sex (or doing all of the above simultaneously), as with these things, there are potential dangers involved in the making oftracer ammunition. The author will attempt to alert the reader along the way to the more obvious safety concerns, and suggest ways to minimize the risk of injury or other problems. Most of all, just use common sense!

For the record, common sense includes things like always wearing rubber gloves, safety glasses and a dust mask while mixing & grinding the chemicals and pressing the tracers, and not mixing the chemicals or pressing the tracers near open flame, nor letting water come into contact with magnesium or the tracer mixture (water and magnesium produces the explosive gas hydrogen). It also means keeping the chemical ingredients out of the reach of children, and making sure you don't set the woods on fire when shooting your new tracer ammo (this is a very real risk, almost a guaranteed thing unless it just rained). It also means that you will make some effort to consult all applicable laws before buying the chemicals, making your tracers, and using them. Please note that to be able to sell tracers or any other type of ammunition you have made, there are numerous state and Federal laws that must be complied with first.

If you are not sure if you possess common sense, consult attorneys, health care professionals, engineers and chemists before proceeding any further.

PLEASE NOTE THAT THIS PAMPHLET IS NOT AN OFFICIAL, SCIENTIFIC DOCUMENT AUTHORED BY CHEMISTS OR BY PERSONS INVOLVED IN THE BUSINESS OF MAKING TRACER AMMUNITION. IT DOES NOT PURPORT TO DESCRIBE A TESTED, SAFE METHOD OF DOING ANYTHING. IT IS ESSENTIALLY NO MORE THAN A COMPENDIUM OF NOTES FROM A COUPLE OF GUYS WHO HAVE TINKERED IN THEIR GARAGES MAKING TRACER AMMUNITION. IT IS NOT OFFERED FOR SALE BUT IS FREELY DISTRIBUTED TO ANYONE WHO WISHES TO READ IT. THE AUTHOR, OR ANYONE SPECIFICALLY MENTIONED IN THIS MANUAL, ASSUMES NO RESPONSIBILITY FOR ANY DAMAGES OR INJURIES SUSTAINED BY ANYONE ATTEMPTING TO DO ANYTHING DESCRIBED HEREIN.

It is highly recommended that this entire pamphlet be read before starting this project With regard to any "shortcuts," the author knows of no shortcuts to the procedures described below. Adaptations using reloading presses etc. have already been tried! Many easier, cheaper things have been tried! This pamphlet describes a technique that has been developed and refined over the course of years, and is one that is proven to work. If you change something, you are in uncharted territory, or more likely in territory that has already been tried and discarded for some reason. You have been warned!

EQUIPMENT

To get started, you will need the following:

1) A small hydraulic hand pump attached to a small hydraulic cylinder, with a psi gauge that reads to about 600 or 1000 maximum psi on the hose near the cylinder. You can find all of this at a hydraulic tool supply shop, or on-line at a tool supplier website. At the time the author got started, the best pump for the job appeared to be a Norco hydraulic hand pump, Model # 925010. It has a 10,000 max psi and is built for heavy-duty use. In most cases you will only actually need to go less than 1,000 psi, so it may be possible to use a smaller, less expensive pump. The #925010 was, however, one of the smaller, less expensive pumps the author could find.

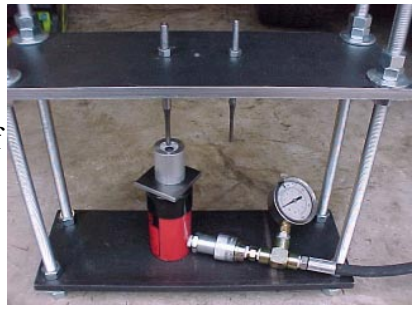
Closeup of cylinder & gauge.

The hand pump is connected with a six foot hydraulic hose to a Norco hydraulic cylinder, Model # 910027A, which is the part that gets pumped up by the hand pump and does the actual pressing of the tracers. As the photo indicates, the author welded a 2" x 2" 1/4" steel plate to the top of the plunger to create a larger platform on which to place the bullet dies described below. To measure the psi, the pressure gauge is attached attached in-line right next to the cylinder. Total cost for this stuff new is around $450, so see if you can find any of it used first.

2) One-ton arbor press. The author bought one new for $35 from Enco, a tool supplier. Their e-mail address is: www.use-enco.com, & phone number is 1-800-USE-ENCO. The model # is 260-101 and says "Phase II". Don't skimp on this, or anything else, because these are things one NEEDS to load tracers successfully. Obtain a short length of 1/4" & 3/16" rod too, available inexpensively at your local hardware store. A small section of rod will need to be affixed to the ends of the arbor press ram.

The author drilled a 1/4" hole on one end, and a 3/16" hole on the other end, of the arbor press ram, to allow the insertion of a short piece of rod. A small hole was drilled & tapped into the sides of these holes to allow a set screw to be put in to prevent the pins from backing out during the pre-pressing step.

3) Press frame. This is a custom part you need to make. Follow these instructions exactly. Obtain two pieces of ½" thick steel plate, and have them each cut to about 6" x 17". Drill 5/8" holes an inch or so inwards from each corner. Then buy four sections of 5/8" threaded rod about 24" long to fit into each corner's hole, and hold everything together with 5/8" nuts, doubling the nuts on the bottom and top as per the photo. You have now made a sturdy, portable tracer making press with just the right amount of flex.



Press frame with cylinder & bullet die on cylinder

You will need to drill at least one hole in the top plate, for the tracer pressing pin. The tracer pressing pin should be a hardened steel punch that you will need to have turned on a lathe to a diameter you can thread for commonly available nuts. A bolt or rod is too soft, so use a punch. For versatility, have one 1/4" punch for pressing .45 ACP tracers, and one 3/16" punch for pressing 9mm tracers turned & threaded, & bolted to the top plate of the press a few inches apart. Leave room for a third if another punch might be needed in the future.

Closeup of press frame pins

4) Black & Decker "Handy Chopper" food chopper. These are about $15 at Wal-Mart. This is a very important item. Don't think you can skip it.

Handy Chopper

Miscellaneous stuff

5) Miscellaneous: Also needed are a mortar & pestle, some small Tupperware containers, a coffee cup warmer or hot plate, a small metal mesh strainer commonly found in grocery stores, some plastic spoons, paper cupcake pan liners, a small scale, rubber gloves, safety glasses and some dust masks.

6) Drill bits. When you press the tracer material into the back of the bullets, the bullets must he held in a supportive die or they will distort all to hell when the pressure comes on them. For loading FMJ .45 ACP (using lead .45 bullets uses a different method and is covered later), you'll need to get a **29/64**" bit. For FMJ 9mm, get a **23/64**" bit.

Sculpted bits.

You will have to sculpt the tip of the bit's profile to match the FMJ bullets' nose profile using a drill and a bench grinder. This is accomplished by putting the bit in a hand drill, setting the drill on reverse, and gently working the spinning bit against the spinning abrasive wheel on the bench grinder. Your goal is to make the profile of the drill bit's tip match the radius and profile of the FMJ bullet you plan to use. (By the way, for 9mm the author uses a 124 gn. Winchester FMJ 9mm bullet.) In a pinch, a Dremel tool with a grinder bit will also work, and can be good for the last finishing work. Then, you'll need to reduce the diameter of the bit on the end by putting the bit in a drill press (preferably in reverse) and holding #320 grit sandpaper to it as it spins. You may need to use up two or three sheets of sandpaper doing this, more so with the .45 drill bit as 29/64 is a bit larger in diameter than .451".

Once you're done and have the diameter and profile right, make sure the cutting edges at the front are sharp & not rounded. These edges can be carefully touched up to sharpness with the edge of a cutting wheel on a Dremel tool. Note: These bits are about $1 from Enco, all you need are the cheap ones since all you'll be drilling is aluminum, and you've got to sculpt it, so don't get super hardened ones. Get at least two each, since you may well FUBAR one trying to get it right the first time. While you're at it, order a short 3/16" drill bit, and a short and a long 3/16" bit. You'll need these for #7 and #8 below.

ALTERNATIVE: If all you want to load is lead .45 ACP tracer ammo, you can skip the drill sculpting and FMJ aluminum die-making step (#7 below) and instead buy a Lyman two-cavity mold for the 230 gn. round nose lead bullet, mold #2660374. What you're going to do is cast a bunch of those bullets, drill the bases out in the drilling jig described later, and use themold itself, with the handles off and with a small C-clamp around it holding it closed, as a bullet-holding die during the pressing operation. Then the bullets are run through a lubri-sizer, then loaded into cases & that's it. If you're really dedicated, get a four-cavity mold just for casting lots of bullets fast, and use the two-cavity mold exclusively as a pressing die.

7) Custom bullet holding dies. These are necessary if you want to load FMJ tracer. Assuming you've already made your bits per #6 above, go to a metal supply shop and have them cut several 1-3/4" sections of 1.5" diameter aluminum rod. Get several because it's almost certain that one or two will end up getting FUBAR'ed. (Don't despair, this is normal.)

True the ends of these aluminum rods in a lathe, then on the lathe drill a 3/16" hole through the center, all the way through. Then place your custom drill bit (#6 above) in the lathe, and drill a hole in one end of this rod slightly deeper than the depth of the bullet you're going to use. Remove the aluminum rod and test fit a FMJ bullet. It should <u>not</u> go in easily with thumb pressure, but <u>should</u> tap in easily & snugly when tapped in with a punch & small hammer. Once it goes in all the way, turn it over & tap it back out with a 3/16" rod or punch. Examine the bullet--it should not be deformed (scratches are OK). If it's a good fit, then get a big drill bit and cut a small "funnel" to ease loading the tracer compound powder.

FMJ pressing dies

If your hole is too big and a bullet drops right in & even rattles a little, the hole is too big and the aluminum rod is FUBAR'ed. Scrap it, & further reduce the bit's diameter using the drill press and #320 grit sandpaper method described in #6 above. A little goes a long way, so don't overdo it. When retesting, don't forget to sharpen the edges of the front cutting surfaces with the Dremel if it needs it. If you reduce the diameter too much, the hole you drill will be too small & the bullet will hardly want to go in even when tapped with a punch, and it will clearly distort on the way in. Luckily, it can be opened up to a proper fit with judicious Dremeling with a fibrous polishing head & testing. Remember, you want the bullet to be a snug fit, that barely starts with strong thumb pressure, but goes in easily with tapping of a punch & hammer, with no major distortion (again, small scratches are OK). The bullet should mike out at the same diameter as a fresh bullet that has not been in & out of the die.

You'll probably FUBAR a couple of aluminum rods & maybe a couple of bits getting these holders right so don't sweat it. The good news is that once you've made a good one, these bullet holders don't ever seem to wear out. Go ahead and make two so you can use two at a time when you really get to a production speed level where you're cranking out tracers like a wildman!

8) Bullet drilling tool - You'll need to buy a large drill chuck, that can preferably hold .30 as well as .45 cal bullets. The author bought one from Enco for $30 that opens up from 3/16"to 3/4", part number 290-1032, and had it welded onto a 1/4" steel plate facing straight up. (See photo.) This plate is C-clamped onto a drill press table in a position where the bullet is held so the drill bit is centered over the base of the bullet. Center it exactly before drilling a bunch of bullets out. If they're off-kilter even a little, they'll likely be inaccurate. Adjust the stops on the drill press so a turn of the handle leaves a nice clean hole at the desired depth in the bullet (about 3/5 of the total length of the bullet). Measure a piece of rod of slightly thinner diameter than the bullet being drilled to place inside the bit for the bullet tip to rest on to hold it at the desired height as the drilling process is undertaken, to prevent the bit from pushing the bullet any lower.

Note piece of bolt inside which acts as a bu stop.

Drilling out bullets.

Once this is set up, you can drill out 100 bullets in 20 minutes or less and long squiggly lead strings will be slinging everywhere. TIP--Since lead wants to gall on steel, after every 10 bullets or so, brush the drill bit with an old toothbrush that has some alox-based bullet lube on the bristles. This slicks up the bit and the lead will not start to stick for at least 10 - 15 rounds.

For .45 ACP, a 1/4" drill bit is an ideal diameter (you may need a special short bit if you're using a small bench drill press). Any bigger and you may have problems with the tracer material burning through the side of the bullet during flight, which will make the bullet inaccurate to say the least. For 9mm, a 3/16" bit is just right.

Smaller bullets like .30 cal and .223 require smaller diameter punches and drill bits, but due to the much higher pressure of these cartridges and the corresponding pressure needed to press the composition, and due to the fact that pre-loaded 7.62 and .223 tracer ammunition is available at modest cost, most people simply buy the pre-loaded tracers. This is not to say you can't load high-power calibers, only that it is more difficult. This pamphlet therefore mainly deals with pistol caliber tracers, although the principles still apply to rifle calibers.

Note C-clamps holding chuck/plate to drill press table.

Remember that the diameters of the bits used in drilling the bullet bases must be the same as those of the pins on the press frame.

CHEMICALS

Below are the raw chemical materials & their respective mixing ratios **(by weight)** needed to make the tracer compound. Order these chemicals from a chemical supply house such as Firefox Enterprises, Inc., www.firefox-fx.com, phone number (208) 237-1976, or Pyrotek, pyrotek@epix.net, (570) 256-3087.

For green tracer:

- Barium Nitrate 60
- Hexachloroethane 20
- Powdered Shellac 10
- #100 mesh powdered Magnesium 30

For red tracer:

- Strontium Nitrate 60
- Hexachloroethane 20
- #100 mesh Powdered Magnesium 30
- Powdered Shellac 10

For amber tracer:

- Barium Peroxide 87
- #100 mesh Magnesium Powder 12
- Powdered Shellac 5

For igniter composition:

- Barium Peroxide 81
- #325 mesh Magnesium Powder 25
- Powdered Shellac 2

Get one pound of everything to start with. The chemicals are pretty cheap, and a pound will load a LOT of tracers. Also, get a can of Denatured Alcohol (use ONLY Denatured alcohol, no other type of alcohol will work) from the hardware store. This will be the solvent used to wet-mix the ingredients. Also get some paper cupcake pan liner cups to weigh out chemicals in, as well as some plastic spoons. You'll discard these once you've measured or scooped one chemical so you don't contaminate the others.

THE BASIC CHEMISTRY--The central ingredient in tracer compounds is the magnesium. It's what burns bright. The strontium nitrate gives the red color, and the barium nitrate gives the green color. Hexachloroethane is a chlorine donor and is added to the reds and greens to give a deeper, richer color. The powdered shellac is what's known as a binder--it holds everything together as a solid when the compound is compressed. Keep in mind that of all the chemicals we're dealing with only the Hexachloroethane is listed in the supplier's manuals as a "poisonous chemical," so treat it carefully, especially when the color mixtures are finely ground.

The strontium nitrate, barium nitrate and barium peroxide are oxidizers, i.e. they help things that are added to them burn. Since magnesium burns quite well all by itself, when you mix magnesium powder to powdered oxidizer it results in a pretty impressive incendiary mixture.

If you light a small pile of tracer compound on the ground, it doesn't blow up, but burns very hot and brightly. It's a very similar compound to what's inside of a Roman Candle type of firework and it spits & sparks & flames much the same way, and even laying on the ground a lit tracer bullet sends out a big, wide jet of flame several inches long, which is why tracers are visible from the sides, and even from the front, as many a combat veteran can attest to.

9mm tracer bullet burning on tin can.

So, keep this in mind if you've got a container full of mixed tracer compound sitting right next to you on your workbench. Keep a lid on it when you're not actually loading, keep it away from flame or water, and in the back of your mind have a disaster plan handy. As in, where are you going to run if you see a spark, or something begin to flame up right in front of you? Have a way cleared for your escape! And have a non-water based fire extinguisher nearby. Remember that if magnesium comes in contact with water, it forms hydrogen gas, which itself is explosive, and is an added danger you need to be aware of.

Don't keep your stores of magnesium or other chemicals around you in your work area, and don't pre-mix a whole lot of compound--you don't need to, a little goes a long way. Don't stir the magnesium into the rest of the mixture with anything other than a wooden stick. Never let there be steel-against-steel contact in any of your operations or otherwise occurring near your work area. Obviously, no smoking nearby! Don't breathe the alcohol fumes or the chemical dusts either (remember, hexachloroethane is a poison), and use rubber gloves to avoid skin contact with any of the powders.

Regarding the igniter mixture, some readers mayrecognize that the recipe above contains a larger amount of magnesium than other recipes which have been floating around in recent years. The author has found that this increase in magnesium from these older recipes greatly increases the reliability of the tracers.

Remember:

DO NOT EVER ALLOW THE MAGNESIUM OR THE TRACER COMPOUND TO COME INTO CONTACT WITH WATER OR SPARKS OR FLAME.

NEVER ADD THE MAGNESIUM TO THE REST OF THE MIXTURES UNTIL **AFTER** THE OTHER CHEMICAL MIXTURES HAVE BEEN COMPLETELY MIXED, DRIED AND GROUND. THE MAGNESIUM IS **ALWAYS** ADDED ONLY AS A **LAST** STEP, AND IS GENTLY STIRRED INTO THE MIXTURE WITH A WOODEN STICK.

IMPORTANT NOTE--With regard to the magnesium powder you'll need for making the Igniter compound, which is needed for everything, you really needto use #325 mesh magnesium powder since it lights a lot better than #100 mesh magnesium powder. The #100 mesh magnesium powder is fine for the red, green and amber tracer mixtures because this is being lit by a magnesium fire, i.e. the igniter mixture. The igniter mixture itself must be lit by the very brief exposure to the fire, heat and pressure of the cartridge going off, and the smaller grained #325 mesh works better in this regard.

Unfortunately, after 9/11/01 all of the common carriers refuse to ship anything finer than 100 mesh magnesium. So, you'll have to try to obtain the #325 mesh magnesium from a fireworks supplier in town, or at a regional fireworks trade show,or the like. One pound will last you a LONG time, so set to work on getting some right off the bat.

MIXING THE CHEMICALS:

Decide what you're going to make first. Then get the appropriate chemicals, the denatured alcohol, your gloves, mask, plastic spoons, cupcake paper cups, mortar & pestle, hotplate, and Handy Chopper nearby & ready. Have a scale nearby (a reloading scale will do, but a small electronic gram scale sensitive to .1 grams and with a 100 gram capacity is perfect as it allows you to lay the cupcake holder on it, zero it out, and then spoon the chemicals in). **Remember, all of the weighing ratios in the tracer mixture recipes are by WEIGHT, not volume.** Do all this in a well ventilated area, such as the garage, with the door open, and preferably have a small fan moving the air past you as you work. Set aside several hours to do this as it takes a long time for the denatured alcohol to dry out as you stir the slurry, and leave yourself some time for cleanup.

Start out with making a small amount of compound at a time at first. You may increase this amount as the scale and proficiency of your operation increases.

Use the plastic spoons & paper cupcake liners to weigh out the chemicals. Discard the spoons & liners after using them on each separate chemical.

Once each chemical is weighed out, dump it directly into the mortar. The author starts with barium nitrate when making green tracer compound, because sometimes it's very clumpy & needs a little crushing first. After everything else is weighed & added to the mortar, add a SMALL amount of denatured alcohol to the mix. Stir it in with a wooden stick or plastic spoon. What you're aiming for is to get the mix to look like fairly dry cake mix batter. WAIT a few minutes as you keep stirring. There is some kind of chemical reaction that occurs and after a few minutes, the "dry" mix suddenly "poofs" out and gets much more liquidy. The whole point of trying to not put too much denatured alcohol in to begin with is because if you do, and THEN it "poofs," it's REALLY liquidy and you have to sit there stirring and waiting until it all evaporates anyway, so it just takes a lot longer.

While the mixture is wet, you MUST keep stirring it, or else all of the shellac binder (now a brown liquid) will separate out to the surface. If you let it sit a few seconds you'll see this start to occur. So you keep stirring. And stirring. Sit the mortar on a coffee cup warmer, or a hotplate on LOW, to speed up the drying process somewhat as you stir.

Eventually it will get thicker, and thicker, until it gets so thick it starts getting almost like clay, and the shellac will appear not to be separating out anymore and the compound appears fairly stiff.

At that point you can leave the material in the mortar, or spread it out on a glass pan. When it totally dries it will really want to STICK to whatever it's on (that's an understatement my friends), so make sure it's on something you can scrape the dried compound off of using a stiff plastic or wooden implement. It seems to take a long time to completely dry, so you may want to set it down for a while under a lamp.

Once it's dried, bust up the dried compound in your mortar & pestle to chunks the size of small marbles or as small as #00 Buckshot if your arm is up to it. You want the pieces small enough so they won't jam up your Handy Chopper. If you weren't wearing them already, make sure you put on your gloves & dust mask since some of the ground powder is going to get in the air & all over very shortly.

Put the busted up compound in the Handy Chopper & start grinding! As you sit there watching the little blades spin around making sandy powder out of your chunks of compound, you will marvel at the wonder of power tools. It would take you HOURS of horrible, forearm-killing, hand-aching work trying to do the same thing manually with a mortar & pestle.

Once most of the contents of the Handy Chopper looks like fine sand, open it up & strain it into the plastic Tupperware tub through the wire mesh strainer. All of the bigger particles will stay in the strainer. Dump these into the mortar, & grind 'em up with the pestle. Strain that, repeat, and so on, until your compound looks nice and uniform and hopefully resembling a yellow-tan fine sand. There will inevitably be a few bigger grains that seem impossible to completely eliminate, so don't sweat

these. This is now a good time to clean things up a bit.

Green tracer compound ready to load.

Next, add the appropriate amount of magnesium powder per the recipes above. Remember, if you're making igniter formula, use #325 mesh magnesium. Weigh it out in a paper cup, & pour it into the Tupperware container holding your compound, & stir it in gently with a wooden popsicle stick or the like until it's thoroughly mixed.

Then put a silica gel pack in it, seal up the container, and it will be ready for loading the next day (allow the silica pack to draw out any moisture overnight).

Keep silica gel packs in all of your stored tracer compound containers. Keep all lids tight!

LOADING THE COMPOUND INTO BULLETS:

CALCULATING PROPER PRESSING PSI - Before you actually start loading, a little bit of math is in order to get you close to where you need to be in your initial loadings as far as the hydraulic press psi ranges are concerned. The formula looks more complicated than it really is. It can be applied no matter what your hydraulic cylinder's head diameter is (which can be found in the manufacturer's spec sheet), what the diameter of your press punch/hole in the bullet is, and whatever the chamber pressure of the round you're going to put the bullet in is.

Here's the three-step formula:

1) *area* of cylinder head ÷ *area* of press punch = Ratio number (recall that *area* = $\prod r^2$)

2) Chamber pressure times 10% = modified chamber pressure number.

3) Divide the modified chamber pressure number by the ratio number. The resulting number is the target psi number you want to begin your tests from.

For initial testing, you would load five tracers each at this number, and several groups of five at 25 psi increments higher and lower than this target number, covering a total range of 100 psi or so.

Example: My hydraulic cylinder's head (the inner part which is in contact with the hydraulic fluid),

has a diameter of 1.69" per it's manual. Thus, it's area is determined by applying the formula to find area, which is "area equals pi times radius squared". Since radius equals ½ of diameter, half of 1.69" is .845". .845 squared is .714. So I multiply .714 times pi (or 3.1415). This equals **2.24"**--there's my area of the cylinder.

Now, the area of a 3/16" pin that's bolted to the top of my press is determined like this: 3/16" is expressed in decimal format as .1875" in diameter. Half of this, or the radius, is .0937. Squared, this is .008. Multiply this times pi (3.1415) gives us **.0275"**, which is the area of the pin's face.

I then divide 2.24 by .0275, which gives me 81. Thus, **81** is my ratio.

Say I plan to load 9mm, and according to an Alliant Powder reloading manual, the chamber psi is about 30,000. Adding 10% gives me 33,000. I divide this by my ratio number of 81, which gives me 407. So, I start my psi test range at 407 psi. In the author's actual experience, about 430 psi on the gauge seems to be the "sweet spot" for my 9mm tracer. The formula works! It gets you close, and it applies to different calibers, different hydraulic head sizes, and different pin sizes, and different cartridge psi's. Using this formula will increase the chances that your initial tests will be fruitful.

PRESSING THE TRACERS--OK, now that you know how to calculate your target psi range, the actual pressing of the tracers is pretty straightforward. If you're loading FMJ, take a predrilled bullet, lay it in the hole in the aluminum die tip downwards, and take your Lee powder measure scooper or some similar plastic or non-ferrous metal scooper and scoop some tracer powder into the hole at the back of the bullet & let some spill over into the depression at the top of the die. Set the die on the arbor press, CENTER IT CAREFULLY, and press down firmly to pre-press the mixture into the hole. This first press also pushes the bullet down into the die. Lift up, jiggle the die or otherwise scoop the spillover powder into the hole in the back of the bullet, & press firmly again. The powdered shellac will hold it together as a solid. There should be about a 1/8" space left in the hole to fill up with the igniter material on the next step.

Arbor press pin pre-pressing tracer compound

Remove the die, and dump the excess powder back in your tracer mix container & give the bottom of the die a light rap with a small brass or aluminum hammer to knock off the loose grains. No waste!

Then take the igniter scooper (have one separate scoop for each mixture) and scoop some igniter mixture on top of the pre-pressed tracer material into the1/8" space at the back of the bullet. Fill it to the top edge of the back of the bullet, but don't obscure the whole back as you'll need to see it enough to be able to CENTER the bullet below the press frame's pin.

Now set the die on top of the hydraulic cylinder ram, which should be positioned on top of the lower shelf of the press frame directly under the appropriate pin affixed to the top of the press frame. With the die centered, pump up the handle slowly until the pin's end makes contact with the igniter material in the hole in the bullet. Make sure everything's lined up & centered. Continue pumping until the needle on the gauge reaches the desired psi. Let it sit for at least five seconds. You'll notice the pressure will slowly drop down as the compound compresses. Don't readjust the psi; as long as the initial psi was reached that's all you need to be concerned with.

Now release the pump's pressure, take the die off the cylinder, hold it upside down over the igniter container & rap the excess off. Then take a flat nosed 3/16" punch of sufficient length & stick it in the hole on the bottom of the die, and rap it with a small brass or aluminum hammer to knock the completed tracer bullet back out. Voila! A real, home-rolled tracer bullet! The first fruit of all your labors.

If you're loading a test batch, mark each bullet with a permanent marker as you make it. For example, mark all bullets loaded to 400 psi with a "1", all 425 psi's with "2", and so on. Have a corresponding "1,2,3" etc. written in a spiral notebook with the corresponding psi's next to the numbers. That way, when you go to the range, you'll be able to keep track of what you're testing with the minimum of confusion.

Test batches ready for the range.

Weigh a few of your bullets after pressing the tracers into them, and use reloading data for that weight bullet, minus a little to be on the safe side (a tracer bullet weighing 100 grains has a longer bearing surface than a shorter 100 grain non-tracer bullet). After loading a batch of tracer ammo, the author sets all of the cartridges on a flat table bunched together pointing up, and takes a piece of foam wet with cheap red or green spraypaint and daubs the tips to give them a nice looking "professional" touch.

Take your new tracers to the range for testing! Make sure there's nothing flammable downrange (including dry vegetation).

When testing, one of three things will happen:

1) There will be a large colored muzzle blast flame. This means the compound was not pressed hard enough and broke apart in the bore.

2) There will be no sign of anything lighting at all. This means the compound was pressed too hard.

3) It will light! Do more testing in that range to find the psi that gives you completely reliable and predictable good lights. If they seem to spark, or spark and/or light not very brightly over a wide psi range, make sure you're using a thick enough later of igniter (1/8" at least), and that you're using the

required amount of #325 mesh magnesium in the igniter per the recipes.

Take notes of all tests. The "sweet spot" psi range should jump out at you when you look at your testing notes. Continue testing until you have achieved a near 100% lighting rate. Note: Green tracer requires a little more pressing psi than the amber mixture, and red requires a little more psi than the green. Experiment and take notes!

Last but not least, after shooting your tracer rounds through your gun, be sure to clean the barrel since these tracers are mildly corrosive. As far as any erosive effects are concerned, the author knows of several guns that have had thousands of these tracers through them, and the barrels still look like new.

Well, you've made it to the end of the pamphlet. Good luck, be safe, and most of all, HAVE FUN!

Author's 9mm tracer bullet & loaded rounds.

-Ted